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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : E21C 35/19, 35/197 — A1

(11) International Publication Number: **WO 97/27383**

(43) International Publication Date: 31 July 1997 (31.07.97)

(21) International Application Number: PCT/EP97/00275

(22) International Filing Date: 22 January 1997 (22.01.97)

(30) Priority Data:

296 01 063.4	23 January 1996 (23.01.96)	DE
296 14 096.1	14 August 1996 (14.08.96)	DE

(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

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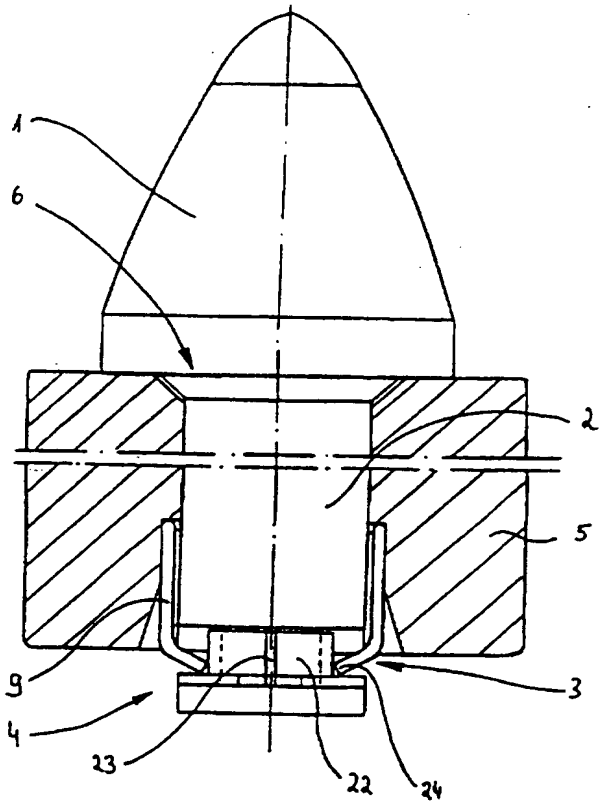
(54) Title: FIXING A CUTTING TOOL IN ITS HOLDER

(57) Abstract

The present invention relates to a shaft bit constituted by a bit body and a holder, the bit shaft being insertable in a receiving opening of the holder and being automatically locked by a spring element. In use, one end of the spring element engages in a constriction at the free end of the shaft. The problem of the invention is to provide a shaft bit with automatic locking, so as to permit a rapid and reliable tool change. This problem is solved in that the spring element comprises an inner part, with which it can be fixed in a first recess of the wall of the receiving opening of the holder and a middle part, which extends in at least one second recess in the vicinity of the free shaft end and is outwardly resiliently constructed and arranged, at least close to the free shaft end, on replacing the shaft bit, together with an outer part, which is in resilient engagement with the shaft in the use position.



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FIXING A CUTTING TOOL IN ITS HOLDER

The invention relates to a shaft bit comprising a bit body and a holder, in which

- the shaft of the bit can be inserted in a receiving opening of the holder and
- following insertion in the holder is automatically secured by a spring element and
- the spring element springs inwards in the vicinity of the receiving opening and
- in the use position engages with one end in a constriction at the free end of the shaft.

Such a shaft bit is e.g. known from US patent 38 33 264, where the holder is extended by a projection at the rearward side. In said projection a spring element is inserted in a keyhole-like opening perpendicular to the bit body axis. This spring element comprises a resilient rubber part, a locking pin with a stop plate and a specially shaped head part, which in the use position engages in a radial slot at the end of the bit shaft. Such a slot or constriction is present on most modern bit bodies, which are nowadays used in large numbers in drilling and mining equipment, on drilling or cutting heads used both above and below ground and even in road grooving rollers. With such use types there is usually no space for extending the holder on the rearward side by said projection.

However, in practice use is mainly made of shaft bits which are not self-locking. With such shaft bits the bit body is secured in the holder by a spring clip or circlip engaging in the constriction. The circlips used are standard parts, which on releasing the locking action are removed in spread form from the holder by a special gripping device engaging in small holes at the ends of the clips. When producing the locking effect the spread circlip is inserted with the gripping device in the constriction, after the bit body has been introduced

into the holder.

The release and also the formation of the locking action on the shaft bit in situ is made very difficult by pronounced contamination, because in any form of advance and mining activity a large amount of fine dust is given off. The dust is firmly deposited in any opening. Therefore, prior to any tool use, a circlip must be firstly exposed and then cleaned to such an extent that the gripping device can act in the relatively small holes. In addition, the circlip is a very small part. It is frequently lost when replacing the bit body and then has to be replaced. Such preliminary work greatly increases the time involved in the routine replacement of a bit body.

In order to reduce the danger of dust explosions and/or to better maintain the purity of the respiratory air in the work area, attempts are usually made to bind the dust by moisture. The moisture can have a corrosive action on the shaft bit and all its components at the elevated ambient temperatures such as are e.g. encountered underground. Together with the frequency of the replacement and the rough ambient conditions, very considerable wear also occurs to a locking element such as a circlip or a spring element according to US patent 38 33 264. Therefore said elements fitted in the holes must be readily accessible for replacement purposes. It is not possible to fulfil these requirements on a head of a mining tool densely occupied with forwardly and sidewardly directed bit bodies. Moreover, particularly underground, the tools are used in extreme danger areas. This makes necessary a simple, rapid and reliable replacement of each of the shaft bit elements.

Thus, the problem of the invention is to provide a shaft bit with an automatic locking of the bit body on insertion into the holder and having a compact overall construction, the spring element being easily fixable even in the case of different holder shapes, without external extensions or shoulders

which are susceptible in the case of mechanical actions, which is readily accessible for maintenance purposes and allows a rapid and reliable tool change.

According to the invention this problem is solved in that

- the spring element comprises an inner part,
- with which the spring element can be fixed in a first recess of the wall of the receiving opening of the holder,
- and a middle part, which extends into at least one second recess in the vicinity of the free end of the shaft
- and at least in the vicinity of the free end of the shaft during the introduction and removal of the shaft with respect to the receiving opening is constructed and positioned so as to spring outwards,
- as well as an outer part, which as the free end of the spring element is in resilient engagement with the shaft in the use position.

The shaft bit according to the invention comprises a bit body, a holder and a spring element having a three-part construction. An inner part of the spring element is responsible for anchoring in the receiving opening of the holder, which in turn has for this purpose a first recess. Through its outer part, the spring element is in resilient engagement with the bit body in the vicinity of the constriction on the shaft and secures the position of the shaft in the holder. A middle part of the spring element joins the inner and outer parts to form a unit. This middle part is guided in a second recess in the wall of the receiving opening inter alia for protection against wear on inserting the bit body and in particular when the shaft bit is in use. Therefore the spring element is protected without external attachments on the shaft bit and is housed in readily accessible manner in the holder as a result of the always large receiving opening.

According to an advantageous further development of the invention, the first recess is formed by a slot in the wall of the

receiving opening which is perpendicular to the hole axis. This slot has a specific cross-sectional shape and radii in the corners. The spring element is resiliently inserted in this slot with its pretensioned inner part during introduction into the receiving opening, so that the spring element is securely, but detachably held in the receiving opening.

Preferably the second recess is also in the form of a slot, having the same cross-section as the aforementioned slot and running parallel to the shaft axis in the wall of the receiving opening. It is used for receiving the middle part of the spring element. Its shape and arrangement lead to no significant weakening of the holder. In the case of a deformation of the holder by pronounced stressing in use, the shape of the slots is intended to prevent a jamming of the spring element in said slots.

According to a preferred embodiment, the middle part of the spring element is in the form of two arms, which in the use position of the spring element are received in two slots running in axially facing manner in the wall of the receiving opening. Thus, the bit body is axially secured from two facing sides on the shaft. Thus, even in the case of breaking off of one of the arms, it is ensured that the bit body is securely held in the holder. The defective spring element is replaced at the same time as the next bit body change.

The spring element is resiliently anchored by means of its pretensioned inner end in the first recess of the receiving opening of the holder. Advantageously said pretension is so dimensioned that the spring element can be manually introduced without any tool into the receiving opening and can be automatically fixed therein by locking in the first recess. The necessary pretension of the inner part of the spring element can be produced by an at least partly circular configuration of the inner part with a correspondingly dimensioned radius. The inner part consequently forms a portion of a torus, whose

internal diameter preferably exceeds the diameter of the recess. Therefore the inner part widens in the vicinity of the first recess and is consequently locked therein.

It is also possible to produce said pretension in that the middle part is tilted towards the surface formed by the inner part. Therefore the spring element is held in the corresponding slots by the inner and middle parts.

Both the aforementioned measures are preferably used in combination. As a result of the advantageous construction of the spring element it is not possible following the introduction of the bit body to remove said spring element, because the bit body shaft is at least partly in contact with the wall of the receiving opening. Therefore the spring element is "confined" in the corresponding recesses. The arrangement is axially secured.

In a particularly advantageous further development of the spring element, the middle part of said spring element as a result of its shaping and the arrangement in the receiving opening, produces the spring tension with which the outer part is in engagement with the constriction of the shaft. Preferably this takes place in that the inserted shaft of the bit body resiliently and elastically presses the middle part out of the inner space of the receiving opening into the axially directed recesses in the wall. As a result of such a displacement of the middle part of the spring element, the latter has a maximum deflection with respect to the outer part in the transition area. For reducing distortion on inserting and removing the shaft, the spring deflection can be extended by a further cut-out. The parts of the spring element fall back into said cut-outs from the transition area from the middle to the outer part without undergoing significant distortion. Advantageously, in the case of corresponding dimensioning this measure has no influence on the spring tension of the axially locking system, but instead leads to an easier replacement of

the bit body, permits an adjustment of the release force of the spring element and protects the said spring element.

It is alternatively possible to produce a large part of the spring action by a torsion spring located in the transition area between the middle and the outer parts of the spring element. The torsion spring can be housed in the aforementioned cut-out, provided that the spring is consequently protected and the spring tension is not unduly reduced.

The outer part of the spring element is preferably formed by a connecting leg and a contact part. The connecting leg bridges the gap between the middle part and the contact part, which is resiliently in contact with the shaft constriction in the use position. The transition between the middle part and the connecting leg is bent, so that the spring tension built up is advantageously transferred to the contact part.

The path of the force necessary for inserting the bit body in the holder over the insertion path can advantageously be fixed by the shaping of the connecting leg. It is dependent on the extent to which the spring element is braced over a half portion. As a result of an arcuate configuration, it is preferably possible to produce an almost linear rise in the force to be expended, which immediately drops with the complete insertion of the bit body and correspondingly with its locking in the holder.

In the simplest case the contact part is formed by a wire end, which is then only in contact at one point with the bit shaft. The contact pressure in this one point is correspondingly high and leads to increased wear. Therefore, in preferred manner, the contact part is constructed so as to be suitable for linear or areal contact, e.g. by torus portions as clamping jaws, whose internal radius corresponds to the external radius of the bit shaft in the constriction.

Another advantage of the shaft bit according to the invention is that the spring element with all its parts has an elongated construction compared with the diameter of the receiving opening. It is therefore easy to handle and can therefore not tilt even on inserting into the receiving opening and is instead always axially guided as a result of its shape. Therefore several free parameters are provided for the adjustment of the spring tension attainable by the middle part.

An important advantage of the present shaft bit is that the spring element with all its components can also be manufactured in one piece, preferably from stainless spring steel in the form of wire. Apart from the easy fixing procedure, this favourable production possibility leads to a cost reduction.

In the case of many known shaft bits, a problem is encountered for a number of reasons when releasing the bit body from the holder. It is frequently necessary to remove auxiliary elements, such as circlips using special tools, or means are required for levering or knocking the bit body out of the holder. In the present invention, between the connecting element and the shaft constriction there is an opening for each spring element arm. The spring tension can easily be eliminated, in that a simple tool, such as e.g. a mandrel, is inserted for the resilient spreading of the connecting element. Therefore the contact part of the spring element is removed from the constriction to such an extent that the shaft, with the thickened end, is freely displaceable in the axial direction, so that the locking action can be removed.

For the preferred case of an automatic locking with a spring element having two arms, a fork-shaped tool having two times and a stop member is proposed, which is inserted in the openings of the arms up to the stop member and consequently eliminates the spring tension.

The shaft bit according to the invention can advantageously be

used both in holders having a receiving opening in the form of a throughhole and in holders, whose side opposite to the receiving opening is closed. These holders are of a conventional nature in certain systems and can be reequipped in the described manner by making recesses, without losing their usability for the particular system.

In the case of the holder with a receiving opening in the form of a throughhole, preferably the two-arm spring element is used. In a further development, at its rear the holder receives two recesses. They are used for guiding the tool. However, they also allow a further use of the previously used shaft bits also in the case of such a holder, because the openings for inserting the tool are displaced into the holder through said recesses. Therefore the bit shaft length need not be adapted to the length of the receiving throughhole. It is also possible in this case to easily replace the bit.

Specifically for the case of a holder closed on one side, according to a further development of the invention use is made of a spring element with a single arm. Therefore this arm passes through only a second recess within the holder. Only one opening is available for tool application. As the tool for opening the automatic locking means it is appropriate to use a simple mandrel, which can be passed through a hole passing in the holder from the outside to the connecting element.

According to a further development contact between the spring element and the bit body is prevented by a collar, which covers the bit body in the vicinity of the constriction. The contact between the bit body which always rotates in use and the spring element lockable in the holder is consequently limited to the constriction and leads there to considerable wear due to the action of dust and moisture. For example for space reasons, the spring element cannot be given a random thickness or strength, in order to provide an adequate amount of material to prevent rapid wear. Thus, under extreme use

conditions said elements can be subject to rapid wear due to dust and moisture. Due to the collar according to the invention at the free end of the bit body, the wearprone contact of the spring element in the constriction is prevented.

Advantageously the collar surrounds the constriction in annular manner and preferably has a L-shaped cross-section for covering a maximum number of contact points between the spring element and the bit body. Thus, the longitudinal side of the constriction and preferably its terminal face on the bit body are covered by the collar.

In a further development the constriction is resiliently surrounded by the collar, so that with corresponding dimensioning of the spring tension an insertion of the collar according to claim 4 can also take place manually and without the use of further tools. The lower limit for the collar spring tension level can be gathered from the condition that the collar must not spring off the bit body under stress.

Significant advantages for the contact between the collar and the spring element used are attainable in that the collar is axially rotatable about the constriction. The matching of the bit surface in the vicinity of the constriction and the inner face of the collar is responsible for the uniformity of the movement between the bit body and the collar. Conventionally both surfaces are formed by cylindrical faces, so that only a matching of the particular radii is necessary.

An easy and rapid insertion of the collar on a bit body can in particular be achieved in that the collar is preferably axially separated at one point Thus, in a plan view of the collar, a virtually C-shaped structure is obtained, whose spring characteristics are advantageously adjustable within a wide-range by geometrical and/or material parameters.

The manual fitting of the collar is further facilitated in

that its axially directed separating faces have bevels, which run apart towards the external radius. This permits a lateral mounting of the collar on the constriction.

As materials for the collar use is preferably made of metals or plastics, which allow an adaptation of the material thickness of the collar to the average bit body wear, so that the bit body is already worn at its cutting edge and must be replaced before the collar becomes worn. Thus, replacement always takes place of units formed by the bit body and inserted collar in a time-saving, single maintenance step and without extra work and time expenditure.

According to an important further development, at least one preferably outwardly directed bulge on the collar forms a driver for the particular spring element. This makes it possible to ensure that a wearing, continuous relative movement only occurs between the collar and the bit body. Thus, the spring element remains protected against such rubbing or grinding movements, so that its life is significantly increased.

A collar with the shape and material described hereinbefore, can be inexpensively manufactured in one piece as a reworkable turned part or injection moulded part. In the form of a unit-assembly system with adaptation possibilities for different bit body constructions, it is also possible to conceive a multipart construction. Longitudinally slotted sleeves and perforated disks separated on one side can cooperate and in particular cover corrosion-intensive or wear-intensive areas of a spring element.

The shaft bit according to the invention with all its further developments is not restricted to the bit body being rotatably held by its shaft in the holder receiving opening. It is generally suitable for uses in holders with a fixed shaft.

The invention essentially relates to the construction and

shaping of the spring element, so that the right is reserved to draft independent claims directed at the spring element. Embodiments of the invention are described in greater detail hereinafter relative to the attached drawings, wherein show:

Fig. 1 A shaft bit.
Fig. 1a A bit body.
Fig. 1b A section through a holder constructed according to the invention.
Fig. 1c A section through the holder in the plane A-B.
Fig. 1d A sectional drawing of an assembled shaft bit.
Fig. 1e A sectional drawing of an assembled shaft bit with additional recess.
Fig. 2a A sectional drawing of an assembled shaft bit with additional recess as in Fig. 1e.
Fig. 2b Another embodiment of the spring element of Fig. 2a.
Fig. 2c Another embodiment of the spring element of Fig. 2a.
Fig. 3a A sectional drawing of an assembled shaft bit with alternative construction of the recess and spring element.
Fig. 3b Another embodiment of the spring element of Fig. 3a.
Fig. 3c Another embodiment of the spring element of Fig. 3a.
Fig. 4a A sectional drawing of an assembled shaft bit with a holder closed on one side and a one-arm spring element.
Fig. 4b A sectional drawing of an assembled shaft bit with through-hole as the receiving hole in the holder and a one-arm spring element.
Fig. 4c A sectional drawing in plane A-B.
Fig. 5a-5c A plan view and side views of a two-arm spring element.
Fig. 6a A shape of the contact part of a spring element.
Fig. 6b Another shape of the contact part of a spring ele-

ment.

Fig. 7a-7c A plan view and side views of a one-arm spring element.

Fig. 8a A sketch of a bit holder rear with two slots.

Fig. 8b A section through the bit holder of Fig. 8a.

Fig. 8c A sketch of a tool for use with the holder of Fig. 8a.

Figs. 9a,9b Sketches of possible slot cross-sections.

Fig 10 A side view of a first embodiment of a shaft bit with collar.

Fig. 11 A part sectional side view of another embodiment of a shaft bit.

Fig. 12a A side view of the embodiment of the collar of Fig. 10 in a sectional view.

Fig. 12b A side view of another embodiment of a collar in a sectional view.

Fig. 13a A side view of the embodiment of the collar of Figs. 10 and 12a.

Fig. 13b A plan view of the collar of Fig. 13a.

Fig. 13c A side view of a sleeve of the embodiment of the collar of Fig. 12b.

Fig. 13d A plan view of the sleeve of Fig. 13c.

Fig. 13e A side view of a disk of the embodiment of the collar of Fig. 12b.

Fig. 13f A plan view of the disk of Fig. 13e.

Fig. 14a A side view of another embodiment of a collar.

Fig. 14b A sectional view in plane A-B of Fig. 14a.

Fig. 14c A sectional view of another embodiment of a collar.

Fig. 15a A side view of another embodiment of a shaft bit with collar.

Fig. 15b A sectional view of the shaft bit of Fig. 15a in plane C-C.

Fig. 1 shows a shaft bit for use in advance and mining tools. It comprises a bit body 1, a holder 5 and a spring element 9.

Fig. 1a shows a known bit body 1. Its essential features are a

shaft 2 with a constriction 3 and a thickened shaft end 4 following onto the same.

In the case of the holder shown in Fig. 1b, in the walls of a receiving opening 6 are provided a first recess 7 in the form of a radial slot and two second recesses 8 in the form of freely running out, axial slots.

The section through the holder 5 level with the first recess 7 shown in Fig. 1c, reveals the issuing of the second recesses 8 into the first recess 7.

The order of the drawings 1a, 1b and 1d illustrates the assembly of the shaft bit by inserting the bit body 1 into the holder 5. To facilitate understanding only in the part sectional representation of Fig. 1d is a spring element 9 also shown. The spring element is made in one piece from stainless spring steel in wire form. Its various embodiments will be described hereinafter. Its inner part 10 engages in the first recess 7 in the form of a radial slot. Through being manufactured with an oversize compared with the receiving opening 6, the spring element 9 is anchored by braking in the holder 5 prior to the insertion of the bit body 1. By means of its middle part 11 the spring element 9 extends into the vicinity of the constriction 3 of the bit body 1. It passes into the second recesses 8 and is therefore protected against damage during the introduction of the bit body 1 or against wear due to the movements thereof, because it can resiliently escape from the inner space of the receiving opening 6 into the slots 8. At its free end, the middle part 11 of the spring element 9 passes out into the outer part 12. Due to the spring tension built up in the spring element 9 with the insertion of the bit body 1, the end of the outer part 12 of the spring element 9, namely the contact part 13, is pressed on the surface of the shaft 2 in the vicinity of the constriction 3 and consequently axially secures the bit body 1. On the spring element 9 the transition of the middle part 11 to the contact part 13 takes

place by a connecting leg 14. Its shape significantly influences the insertion behaviour of the arrangement. Certain variants are shown in figs. 2a to 3c together with a further constructional measure for influencing the behaviour of the spring element 9 when replacing the bit body 1. It is a terminal extension of each second recess 8 by a cut-out 15. Fig. 1d shows a holder 5 without a cut-out 15 and Fig. 1e shows a holder 5 with a cut-out 15. The cut-out 15 firstly takes over the function of significantly extending the spring displacement of the middle part 11 compared with Fig. 1d and secondly receives parts of the spring element 9 on replacing the bit body 1. Thus, the spring element 9 during the replacement process is not only bent in a punctiform area. The elastic deformation of the connecting leg and further spring parts is also avoided. This permits the replacement process to be carried out with reduced force expenditure. Figs. 2a-c and 3a-c show two shapes of the cut-out 15 and Figs. 3a-c show a variant of the cut-out 15 of Figs. 2a-c. In Figs. 3a-c, the cut-out 15 is adapted to the shape of the inserted spring element with a torsion spring between the middle part 11 and connecting leg 14. A larger proportion of the spring tension is produced here by deformation in the torsion spring and less by the deformation of the middle part 11.

Figs. 4a and 4b show an alternative construction of the spring element 9 with a middle part 11, which only comprises one arm. Fig. 4a shows the shaft bit with a holder 5 closed on one side and Fig. 4b an arrangement with a throughhole as the receiving opening 6. Despite the different construction length of the shaft 2 of the bit body 1, in both cases the same spring element 9 is used. A section through the arrangements level with the first recess 7, the radially directed slot in the receiving opening 6, gives the same picture with both use forms, as is shown in Fig. 4c. Symmetrically to the centre axis the inner part 10 of the spring element 9 describes more than a semicircle in the first recess 7, which ensures a reliable hold of said spring element.

Figs. 5a-5c show the construction of a spring element with two facing arms forming the middle part 11 and with a semicircular inner part 10. The connecting leg 14 of each arm passes arcuately into the inner space of the receiving opening 6. The contact parts 13 at the ends of the connecting leg 14 are constructed as symmetrical torus portions for holding the bit body 1 at the constriction 3.

Fig. 6a shows the shape of the contact parts 13 in contact with the constriction 3 of the bit body 1 in the form of a sectional representation.

Fig. 6b shows the simplest shape of such contact parts 13 in the same representation as Fig. 6a. On comparing the drawings, it can be seen that the punctiform contact of Fig. 6b has been transformed into an at least linear contact in Fig. 6b. Although both possibilities are usable, the variant of Fig. 6a has the advantage of reduced surface pressure. Therefore there is less stressing of the material in the contact area.

Figs. 7a-7c show a one-arm spring element of Figs. 4a and 4b extended by the contact part 13 of Fig. 6a. Two portionwise parallel wire sections together form the contact part 13 of the spring element 9. Thus, apart from an almost areal surface contact, there is a high spring rigidity for reliable axial securing.

The replacement of a bit body 1 takes place in simple manner. In Figs. 1d to 3c in each case between a connecting leg 14 of the spring element 9 and the constriction 3 of the shaft 2 an opening 16 is provided. The holder 5 is always manufactured in such a way that the said opening 16 is accessible from the outside. Any tool slightly conically tapering towards the end is suitable for removing the locking action by supporting the spring element 9 through the insertion of the tool into the opening 16.

Figs. 8a and 8b show an extension of the rear of a holder 6. Fig. 8c shows a tool 17 for removing the locking action when replacing the bit body 1 in an arrangement according to Fig. 1d with open holder 5 and a two-arm spring element 9 according to Figs. 5a-5c. The tool 17 is guided in parallel slots 20 on the side of the holder 5 remote from the receiving opening 6. The tines 18 of the tool 17 engage in the opening 16. On further inserting the tool 17, the spring element 9 is spread in the vicinity of the connecting leg 14 in such a way that the contact parts 13 are released from the constriction 3 and the bit body 1 is freed as soon as the tool 17 reaches the stop member 19. Apart from guidance, the slots 20 also serve to adapt a holder 5 and a bit body 1, designed for the existing locking concepts, to locking by the spring element 9 as a component of the shaft bit according to the invention. Thus, the engagement area of the contact parts 13 in the constriction 3 can be displaced into the holder 5 in the case of a shorter shaft 2. Deep slots 20 can optionally be replaced by bores 21, in order to prevent any weakening of the holder 5.

The pronounced stressing of the shaft bit in use can give rise to a distortion on the holder 5. However, the function of the spring element 9 must not be impaired by any jamming. Therefore for the first recesses 7 and second recesses 8 in the holder, special cross-sections have been chosen, such as are shown in Figs. 9a and 9b. A reduction of the notch effect is achieved in that all the corners or angles are constructed in the form of radii, which is not apparent from the sketches.

Fig. 10 shows a shaft bit, whose bit body 1 is axially secured by a locking element, here a spring element 9, in a receiving opening 6 of a holder 5, the spring element 9 engaging on the free, thickened end 4 of the shaft 2 in a constriction 3 of the bit body 1, which is lined by a collar 22. The embodiment of a collar 22 shown in Fig. 10 has in the axial direction a separation 23 and is consequently fittable by hand on the bit

body 1 and resiliently surrounds the constriction 3. In addition, the collar 22 is so constructed that it is axially rotatable about the constriction 3 under use conditions. Thus, there is no longer any direct contact between the spring element 9 or ends 24 of the latter and the surface of the constriction 3 which, due to the rotary movement of the bit body 1 and pronounced contamination by dust and moisture, could lead to increased wear and corrosion to the spring element 9.

Fig. 11 shows a modified locking concept using the collar 22 in the form of a sectional representation in side view. The receiving opening 6 is lined with a hollow cylindrical body 25 of a specially finished, resistive metal having recesses for receiving a modified spring element 9a according to Fig. 3a. This spring element 9a also axially and rotatably secures the bit body 1 in the holder 3, in that it engages at the free end 4 in the constriction 3. As in the embodiment of Fig. 10, the constriction 3 is lined by a collar 22, so that there can be no direct contact between the constriction 3 and the end 24 of the spring element 9a. The collar 22 rotates around the constriction 3 and is subject to wear in place of the spring element 9a.

Figs. 3a and 3b show two embodiments of the collar 22 of Figs. 10 and 11 in a sectional representation in side view. The collar 22 of Fig. 12a has a L-shaped cross-section, through which the possible contact area of a spring element 9 with the surface of the bit body 1 can be covered in the vicinity of the constriction 3 and as can be gathered from Figs. 10 and 11. The collar 22 of Fig. 12a is in one piece, whereas the collar 22 of Fig. 12b is in multipart form, here e.g. in two parts constituted by a sleeve 26 and a disk 27. The collar 2 of Fig. 12b is adaptable through differently long sleeve portions 26 for use in constrictions 3 of differing widths.

Fig. 13a is a side view of the embodiment of the collar 22 of Fig, 10. This embodiment of the collar 22 with a L-shaped

cross-section is formed by the one-piece construction of a slotted sleeve 26a and a separated disk 27a. The disk 27a has in the vicinity of the separation 23 bevels 28, which facilitate the manually performable mounting of the collar 22 on the bit body 1.

Fig. 13b is a plan view of the collar 22 of Fig. 13a, in order to illustrate the configuration of the bevels 28 in the vicinity of the separation 23. The path of the cutting edges of the disk 27, without bevel 28 is shown in broken line form. The multipart embodiment of Fig. 13b can in principle comprise the same parts as the collar 22 of Fig. 12a. For reasons of completeness, both parts are shown in side view and plan view in Figs. 13c to 13f. Figs. 13c and 13d show a sleeve, which in the vicinity of the opening 23 or slot also has a bevel 28. The insertion of the disk 27 can be facilitated by holes 29, so that the disk 27 is insertable in the same way as a conventional circlip, as can be gathered from Fig. 13f.

Fig. 14a is in side view another embodiment of a collar 22. It is once again a one-piece collar 22, on whose sleeve 26 there are two recesses 30 together with the corresponding bulges 31. This leads to the formation of drivers 32 for the spring element 9. In the present case U-shaped parts are separated from the sleeve 26a and bent outwards as bulges 31, so that drivers 32 are formed, which prevent a further spinning of the spring element 9. Fig. 14b shows this construction in sectional form in plane A-B of Fig. 14a.

Fig. 14c shows an alternative solution to Fig. 14b, which has a stop member 33 as a fold 34 in the vicinity of the opening 23 on the sleeve 26a. Both solutions are not restricted to one-piece collars 22 and are instead usable in random multipart embodiments.

Fig. 15a shows another embodiment of a collar 22 used in a shaft bit with a circlip 35 as the locking element. The collar

22 has a U-shaped cross-section, so that it protectively surrounds the circlip 35 and the locking element is consequently reliably embedded with respect to any area of the constriction 3. According to the already described solution principles such a U-shaped collar can be implemented in multipart form, e.g. as a double L. It would be possible to fix the circlip 35 to the holder 5 e.g. by a stop member welded onto said holder 5, but which is not shown in Fig. 15a. Thus, by a simple reequipping step, any continuous relative movement between the holder 5 and circlip 35 can be prevented and displaced into the vicinity of the constriction 3 between the collar 22 and bit body 1. Thus, scarcely no wear occurs to the circlip 35 as the locking element.

Fig. 15b shows in a section in plane C-C of Fig. 15a, how the sleeve 26 of the one-piece or multipart collar 22 is surrounded by the circlip 35. These collars 22 and also the other collars 22 described hereinbefore can be made from plastics or metals, provided that the spring rigidity and wear can be adjusted in accordance with the requirements of a use according to the invention.

Claims

1. Shaft bit comprising a bit body and a holder, in which
   - the shaft of the bit can be inserted in a receiving opening of the holder and
   - following insertion in the holder is automatically secured by a spring element and
   - the spring element springs inwards in the vicinity of the receiving opening and
   - in the use position engages with one end in a constriction at the free end of the shaft,

   characterized in that
   - the spring element (9) comprises an inner part (10),
   - with which the spring element (9) can be fixed in a first recess (7) of the wall of the receiving opening (6) of the holder (5),
   - and a middle part (11), which extends into at least one second recess (8) in the vicinity of the free end of the shaft (2),
   - and at least in the vicinity of the free end of the shaft (2) during the introduction and removal of the shaft with respect to the receiving opening (6) is constructed and positioned so as to spring outwards,
   - as well as an outer part (12), which as the free end of the spring element (9) is in resilient engagement with the shaft (2) in the use position.

2. Shaft bit according to claim 1, characterized in that the first recess (7) is constructed as a slot perpendicular to the shaft axis and the inner part of the spring element (9) can be inserted with pretension in said slot.

3. Shaft bit according to either of the preceding claims, characterized in that the second recess (8) for receiving the middle part (11) of the spring element (9) is con-

structed as a slot, parallel to the shaft axis, in the wall of the receiving opening (6).

4. Shaft bit according to one or more of the preceding claims, characterized in that
   - the middle part (11) of a spring element (9) is constructed in the form of two arms and
   - in the receiving opening (6) are provided two recesses in opposite positions,
   - with each of which is associated one arm.

5. Shaft bit according to claim 2, characterized in that the pretension of the spring element (9) is dimensioned in such a way that the manual insertion of the spring element (9) is possible without further aids.

6. Shaft bit according to claim 5, characterized in that the inner part (10) of the spring element (9) has an at least partly circular configuration for the appropriate building up of a corresponding pretension, the diameter of said circle being larger than the internal diameter of the receiving opening (6).

7. Shaft bit according to one or more of the preceding claims, characterized in that the at least one middle part (11) of the spring element (9) is not perpendicular to the surface formed by the inner part (10) of the spring element (9).

8. Shaft bit according to one or more of the preceding claims, characterized in that through the construction of the middle part (11) of the spring element (9) and its arrangement in the receiving opening (6), the spring tension of the outer part in engagement with the constriction (3) of the shaft (2) can be attained.

9. Shaft bit according to claim 8, characterized in that the middle part (11) of the spring element (9), at least close to the free end of the shaft (2) on insertion of the bit body (1) into the receiving opening, can resiliently give way with respect to the shaft end (4) thikkened compared with the constriction (3), when the middle part (11) is directed inwards following the insertion of the spring element (9) in the receiving opening (6).

10. Shaft bit according to one or more of the preceding claims, characterized in that the spring displacement can be correspondingly extended by an additional cut-out (15) in the axial slot (8) in the vicinity of the outer part (12) of the spring element (9).

11. Shaft bit according to one or more of the preceding claims, characterized in that, in the vicinity of the outer end (12), the spring element (9) has turns, preferably in the form of a torsion spring, perpendicular co the axis of the shaft (2).

12. Shaft bit according to one or more of the preceding claims, characterized in that the second recess (8) issues into a cut-out (15) at the end of the receiving opening (6).

13. Shaft bit according to one or more of the preceding claims, characterized in that at least a part of the portion of the middle part (11) of the spring element (9) producing the engagement spring tension is located in the cut-out (15).

14. Shaft bit according to one or more of the preceding claims, characterized in that the outer part (12) of the spring element (9) comprises a connecting leg (14) and a contact part (13).

15. Shaft bit according to claim 14, characterized in that the connecting leg (14) is bent at the end from the middle part (11) of the spring element (9).

16. Shaft bit according to claim 14, characterized in that, in the vicinity of the connecting leg (14), the spring element (9) is arcuate to facilitate insertion of the bit body (1) in the receiving opening (6) and the extension of the spring displacement, in such a way that the connecting leg (14) of the spring element (9) passes axially with a shallow angle to the constriction (3) of the shaft (2).

17. Shaft bit according to claim 14, characterized in that the contact part (13) is formed by torus portions, whose internal radius corresponds to the external radius of the bit shaft (2) in the constriction (3).

18. Shaft bit according to one or more of the preceding claims, characterized in that the spring element (9) has an elongated construction compared with the diameter of the receiving opening (6).

19. Shaft bit according to one or more of the preceding claims, characterized in that the spring element (9) is built up from several corrosion-resistant parts, preferably made from stainless steel, particularly in the form of wire and in one piece.

20. Shaft bit according to one or more of the preceding claims, characterized in that the spring tension can be eliminated, in that a simple tool (17) is inserted in an opening (16) between the connecting leg (14) and constriction (3) of the shaft (2) for the resilient spreading of the connecting leg (14), so that the contact part (13) of the spring element (9) is removed to such an extent from the constriction (3) that the shaft (2)

with the thickened end (6) is free and easily removable.

21. Shaft bit according to one or more of the preceding claims, characterized in that the automatic locking can be removed in the case of a spring element (9) having two arms, in that a fork-shaped tool (17) having two tines (18) and a stop member (19) is inserted in the opening (16) up to the stop member.

22. Shaft bit according to claim 21, characterized in that, on the side remote from the receiving opening (6), the holder (5) has two parallel slots (20) for guiding the tool (17).

23. Shaft bit according to one or more of the preceding claims, characterized in that the holder (5) has a receiving opening (6) in the form of a throughhole.

24. Shaft bit according to one or more of the claims 1 to 20, characterized in that on the side opposite to the receiving opening (6) the holder (5) is closed.

25. Shaft bit according to claim 23, characterized in that
- the holder (5) is provided with a first recess (7), a second recess (8) and a cut-out (15),
- in same is inserted a spring element (9) with a middle part (11) formed by an arm and
- in the holder a bore (21) runs from the outside to the connecting leg (14) in the vicinity of the opening (16).

26. Shaft bit according to one or more of the preceding claims, characterized in that the shaft (2) is rotatable in the bore of the holder (5).

27. Shaft bit according to one or more of the preceding claims, characterized in that the shaft (2) is not rota-

table in the bore of the holder (5).

28. Shaft bit according to one or more of the preceding claims, characterized in that
- the constriction (3) in the contact area with a locking element, preferably a spring element (9),
- is at least partly coverable by a collar (22), in such a way that
- a direct contact between the locking element and bit body (1) in the constriction (3) can be prevented.

29. Shaft bit according to claim 28, characterized in that the collar (22) is annular and preferably has a L-shaped cross-section.

30. Shaft bit according to either of the claims 28 and 29, characterized in that the collar (22) resiliently surrounds the constriction (3).

31. Shaft bit according to one or more of the claims 28 to 30, characterized in that the collar (22) can be manually fitted.

32. Shaft bit according to one or more of the claims 28 to 31, characterized in that the ring formed by the collar (22) has a separation (23) at one point.

33. Shaft bit according to one or more of the claims 28 to 32, characterized in that the collar (22) has bevels (28) in the vicinity of the separation (23).

34. Shaft bit according to one or more of the claims 28 to 33, characterized in that the collar (22) is axially rotatable around the constriction (3).

35. Shaft bit according to one or more of the claims 28 to

34, characterized in that the collar (22) can be made from metal and/or plastic.

36. Shaft bit according to one or more of the claims 28 to 35, characterized in that on the collar (20) at least one bulge (31) forces a stop (33) as a driver (32) for the locking element.

37. Shaft bit according to one or more of the claims 28 to 36, characterized in that the collar (22) is in one piece.

38. Shaft bit according to one or more of the claims 28 to 36, characterized in that the collar (22) is in multi-part form and comprises at least one slotted sleeve (26) and/or a slotted disk (27).

39. Shaft bit according to one or more of the claims 28 to 38, characterized in that the collar (22) has a U-shaped cross-section.

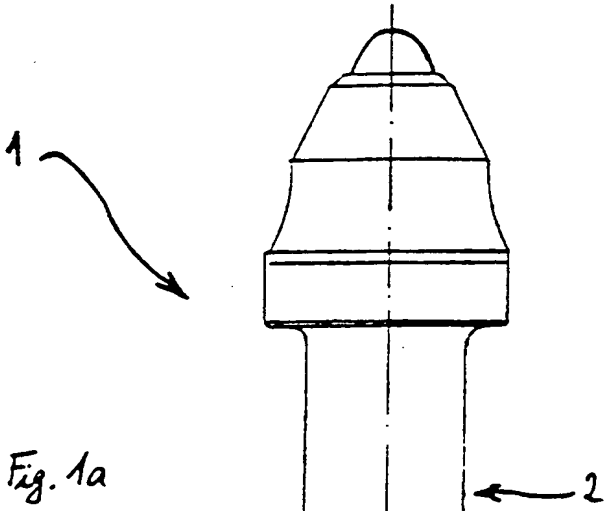


Fig. 1a

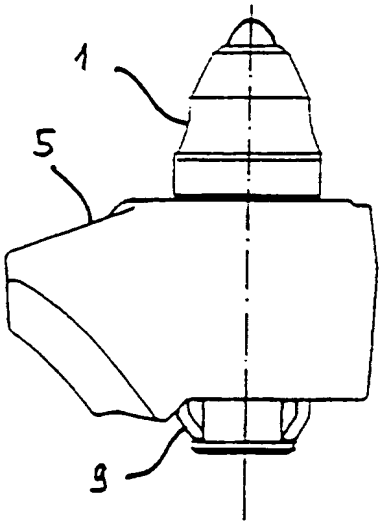


Fig. 1

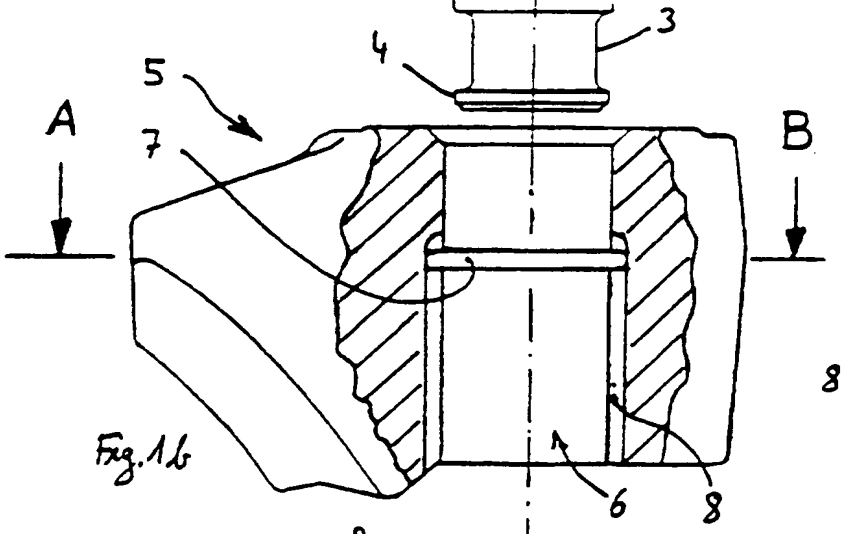


Fig. 1b

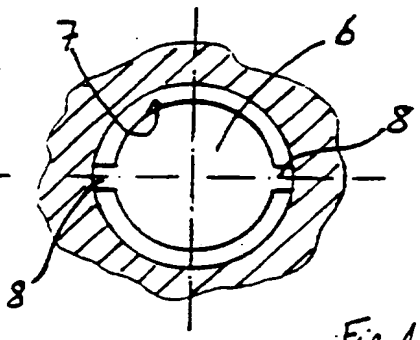


Fig. 1c

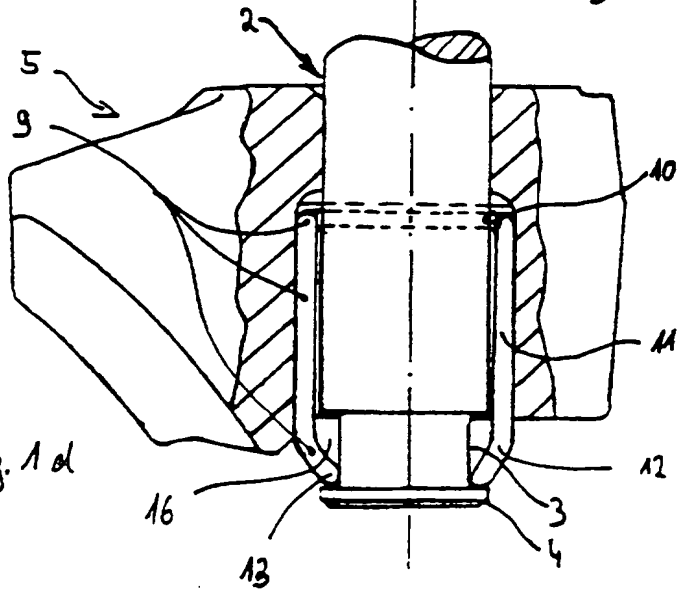


Fig. 1d

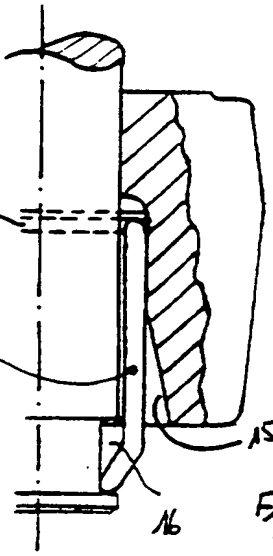


Fig. 1e

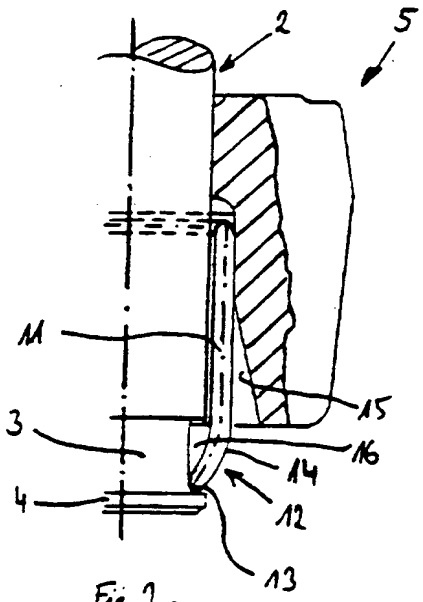


Fig. 2a

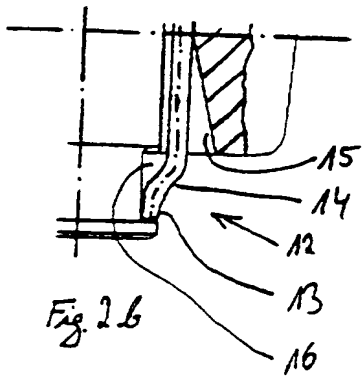


Fig. 2b

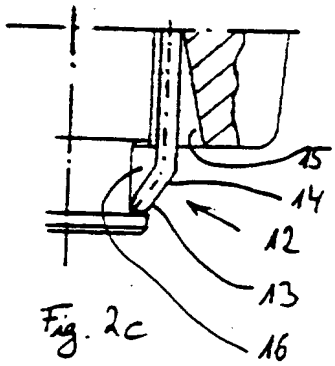


Fig. 2c

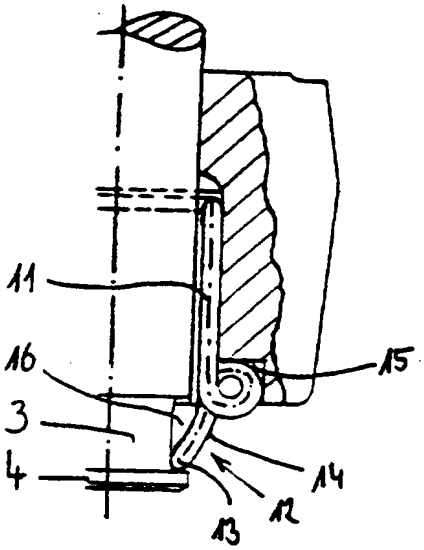


Fig. 3a

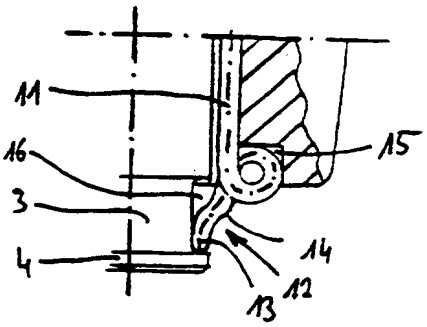


Fig. 3b

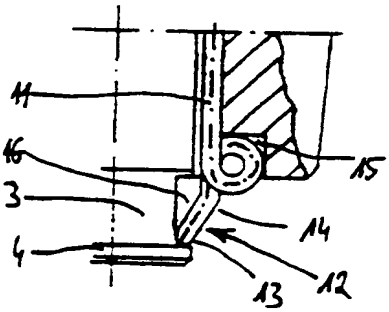


Fig. 3c

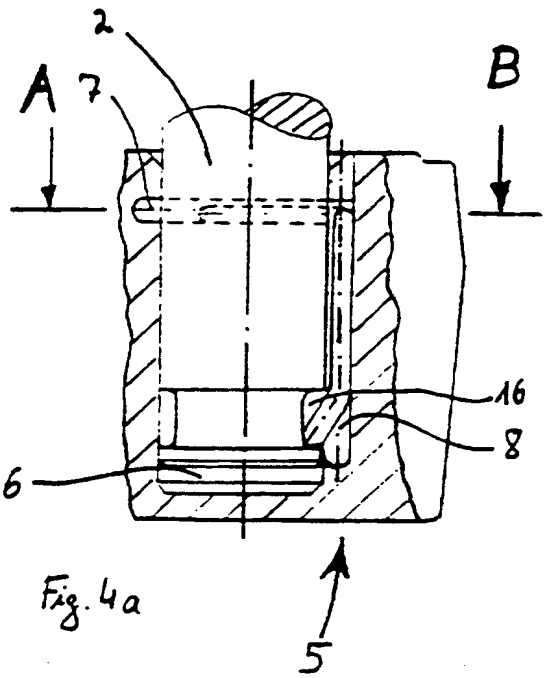


Fig. 4a

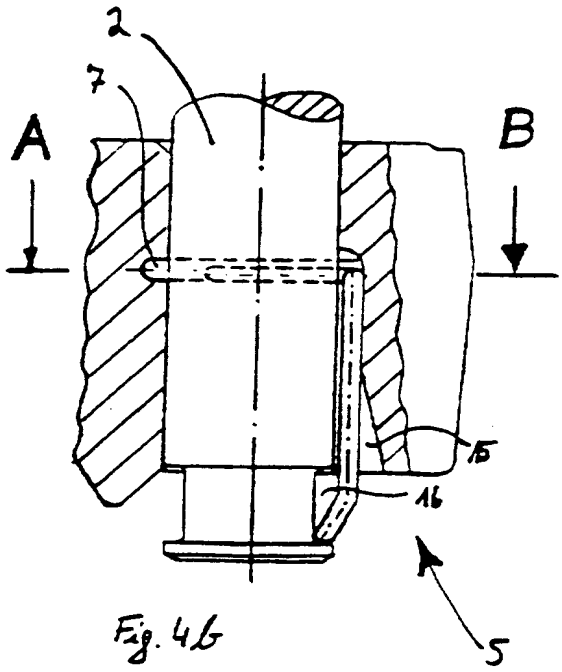


Fig. 4b

A - B

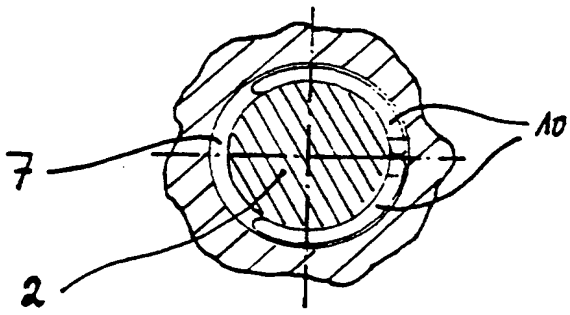


Fig. 4c

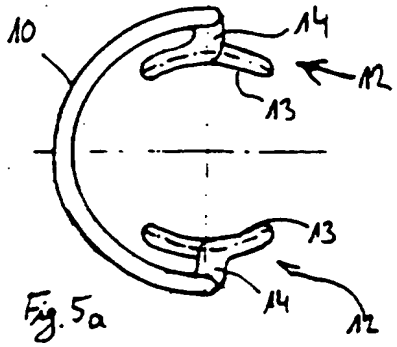


Fig. 5a

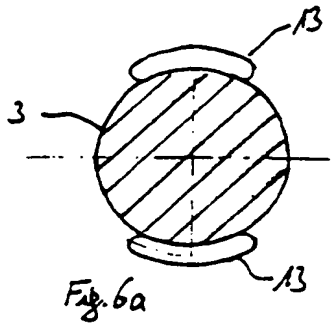


Fig. 6a

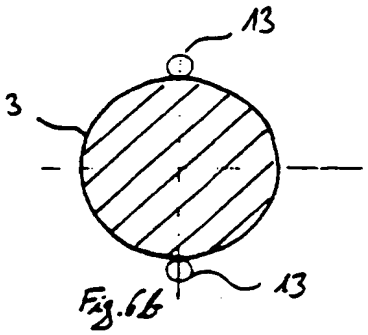


Fig. 6b

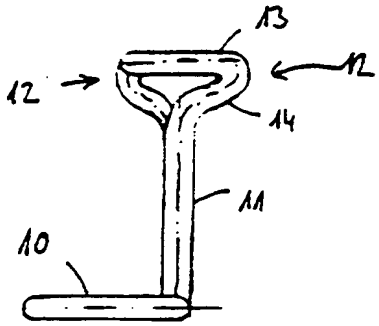


Fig. 5b

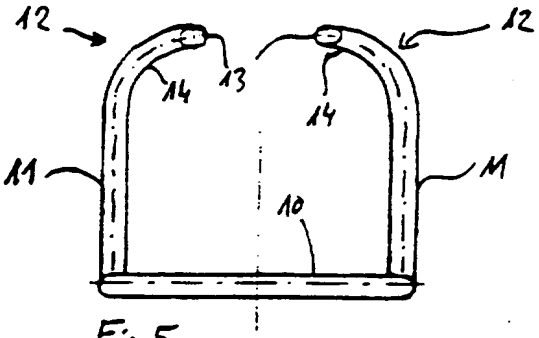


Fig 5c

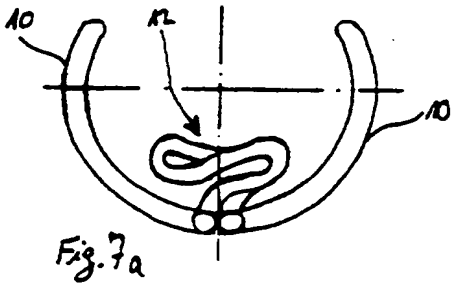


Fig. 7a

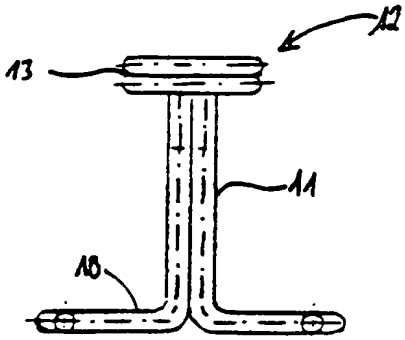


Fig. 7b

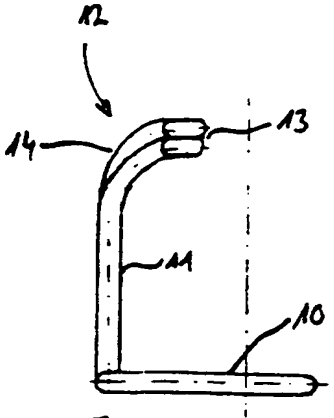


Fig. 7c

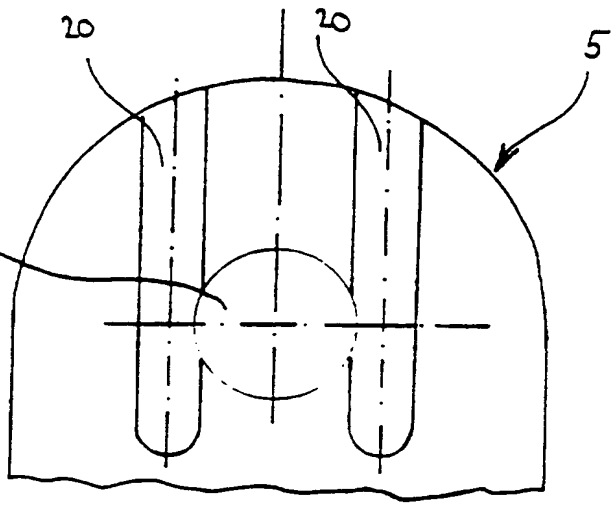


Fig. 8a

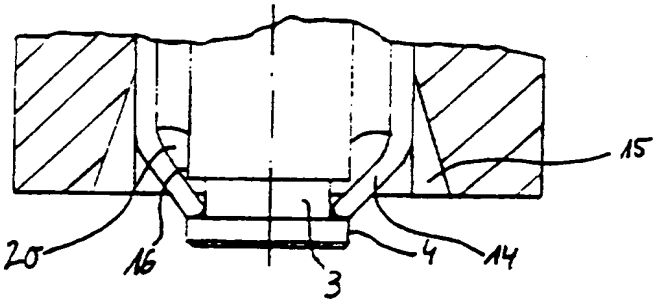


Fig. 8b

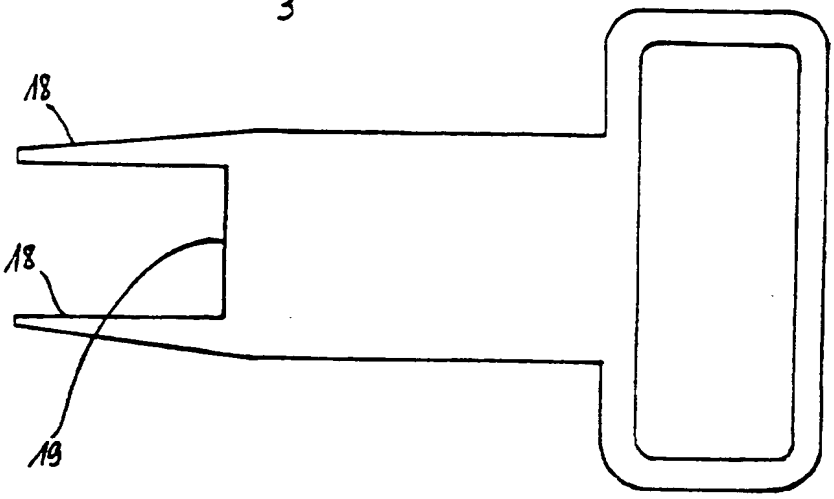


Fig. 8c

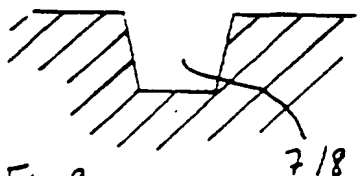


Fig. 9a

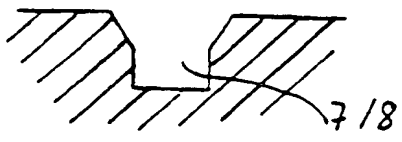


Fig. 9b

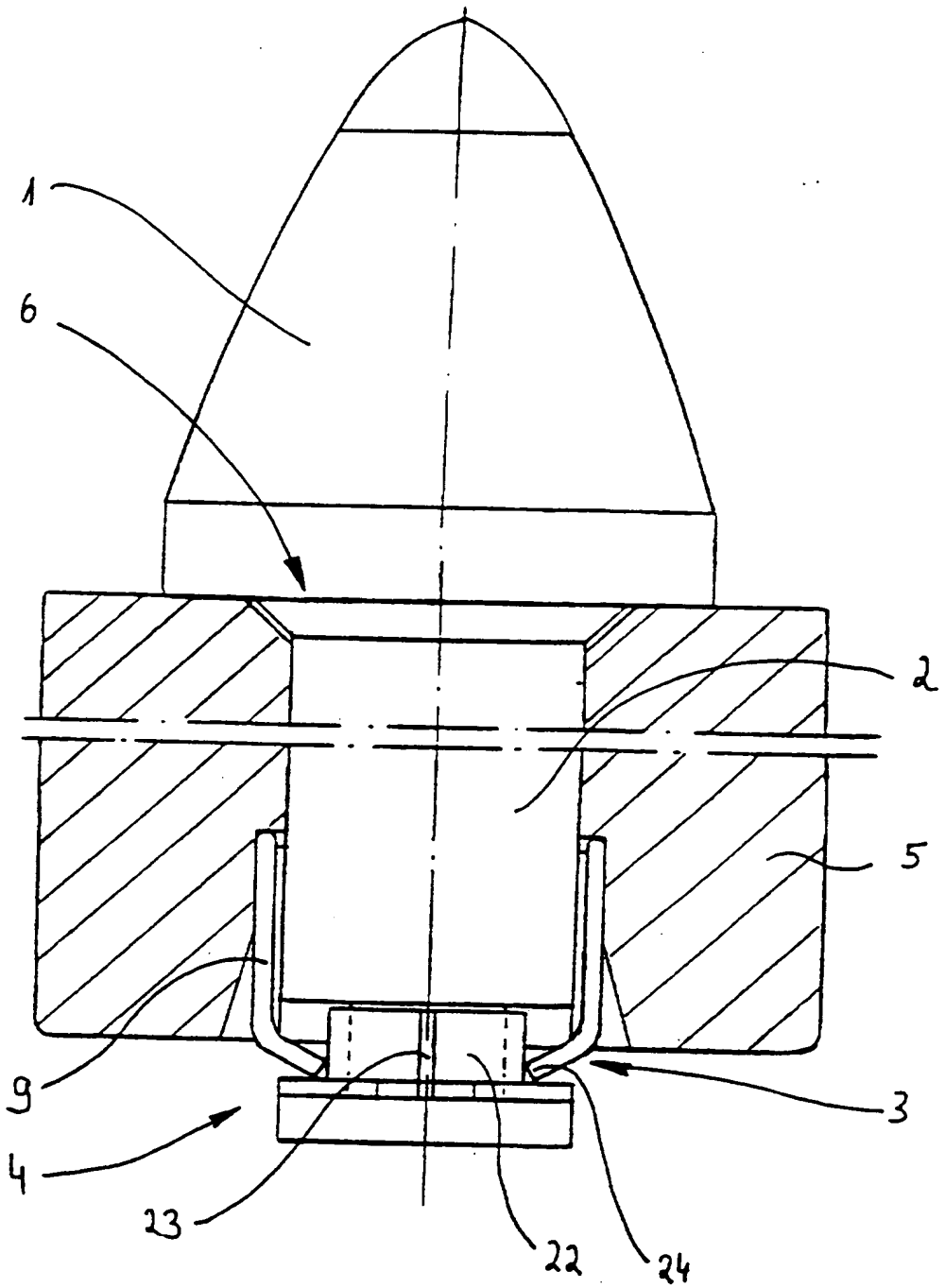


Fig. 10

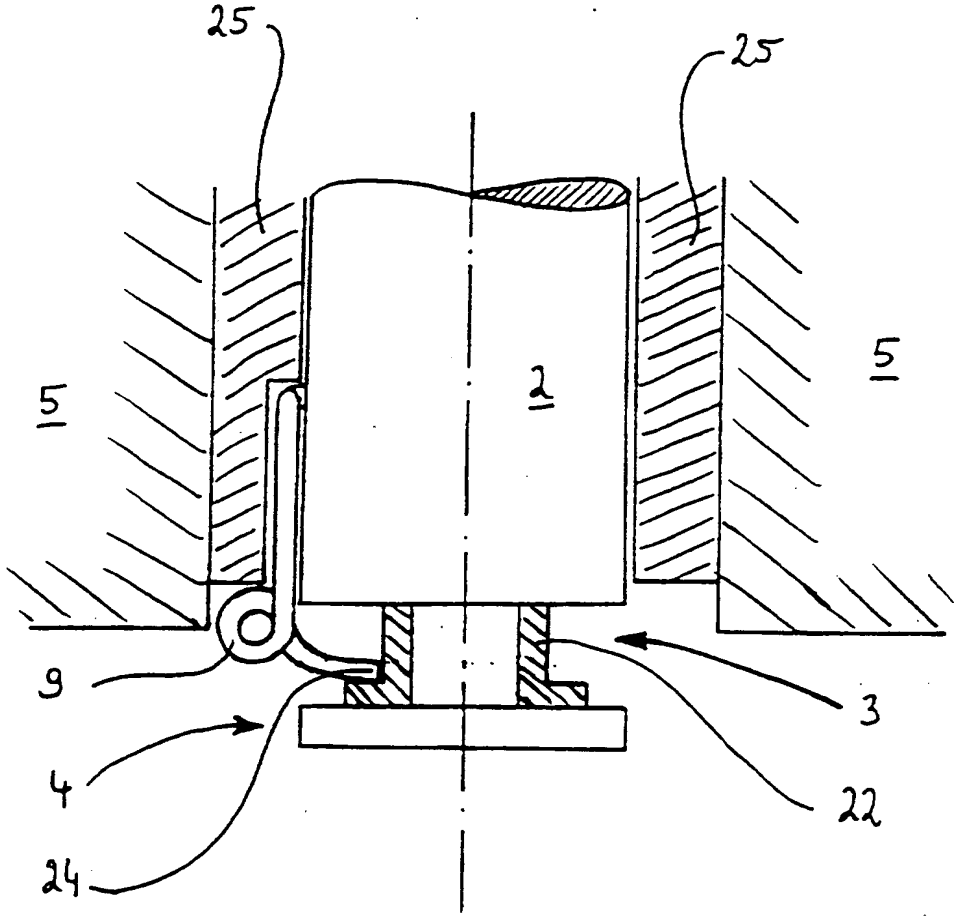


Fig. 11

Fig. 12 a

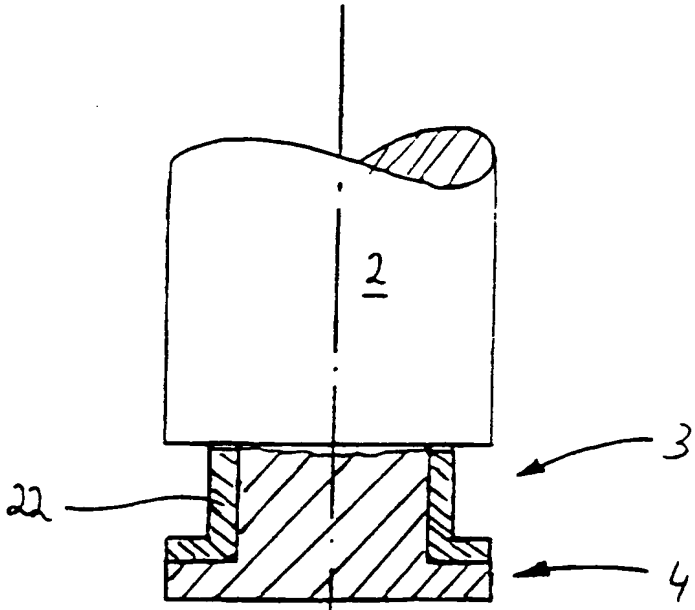


Fig. 12 b

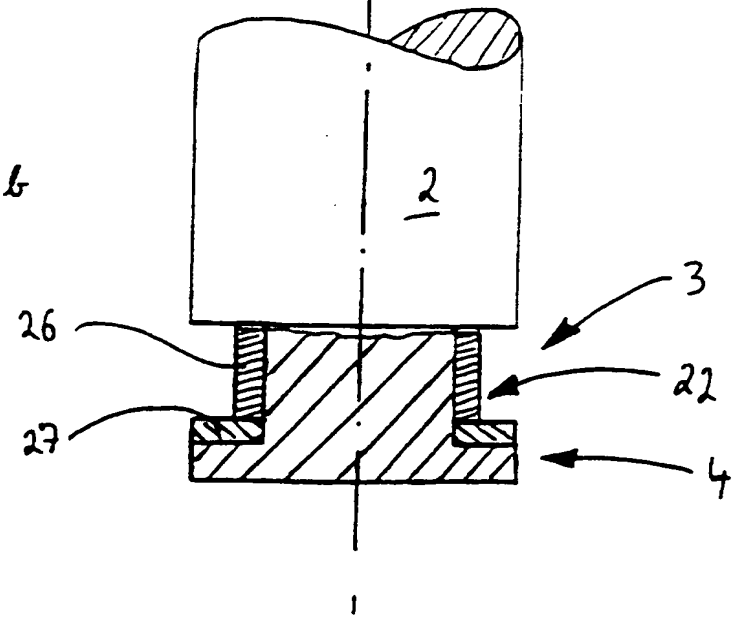


Fig. 13a

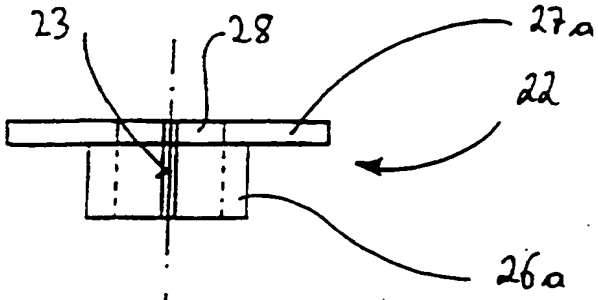


Fig. 13b

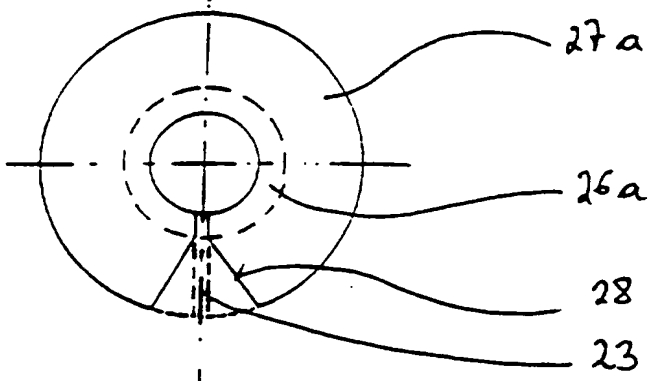


Fig. 13c

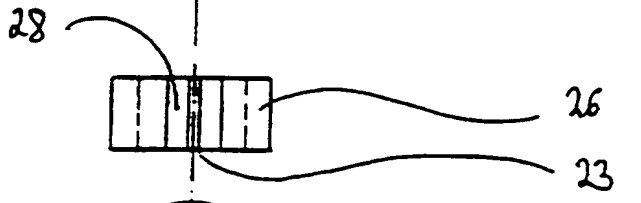


Fig. 13d

Fig. 13e

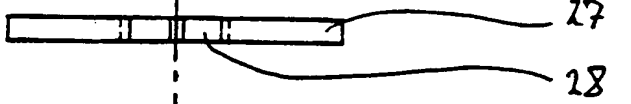
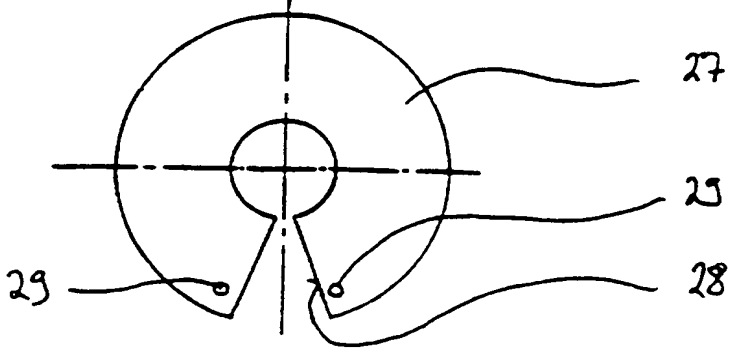


Fig. 13f



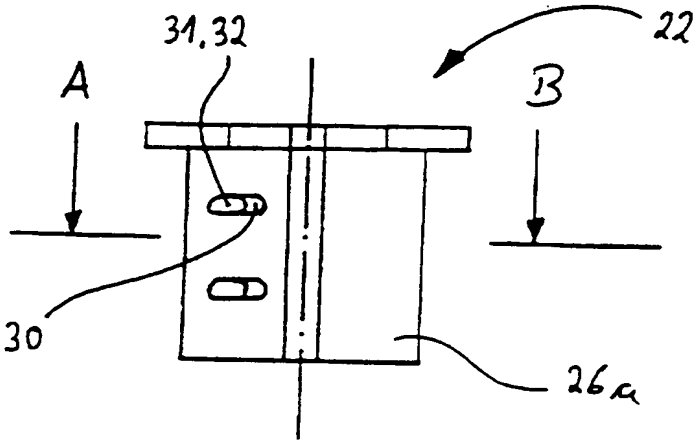


Fig. 14a

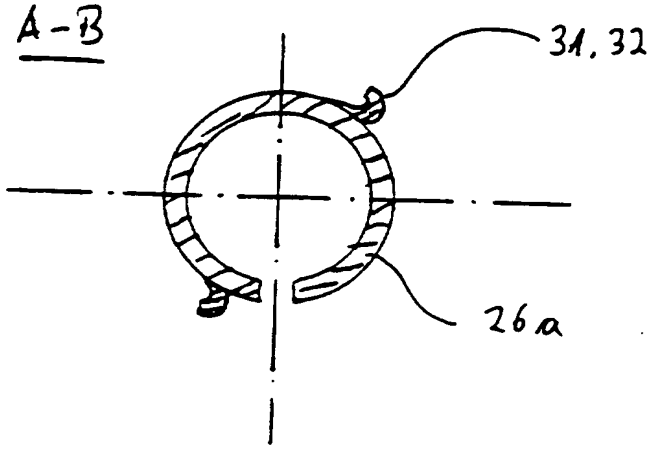


Fig. 14b

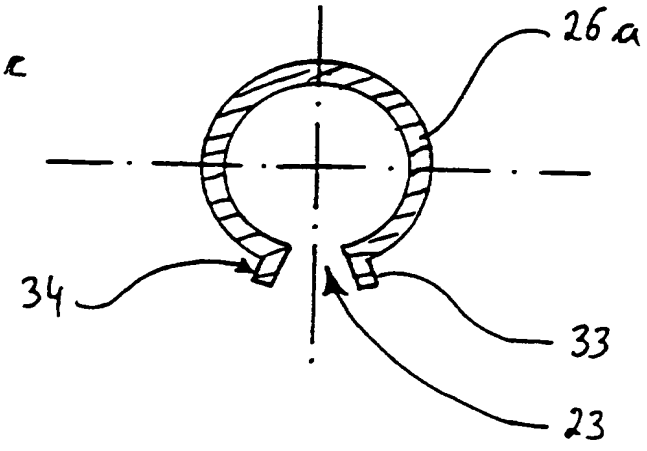


Fig. 14c

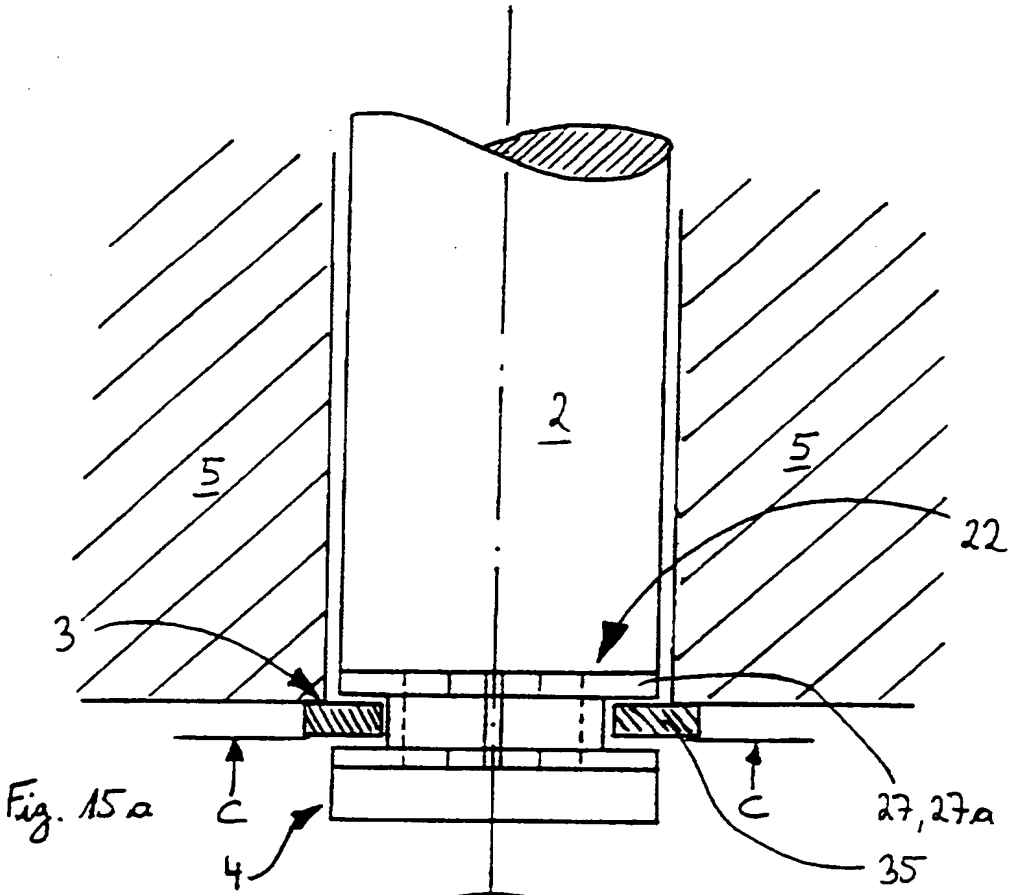


Fig. 15a

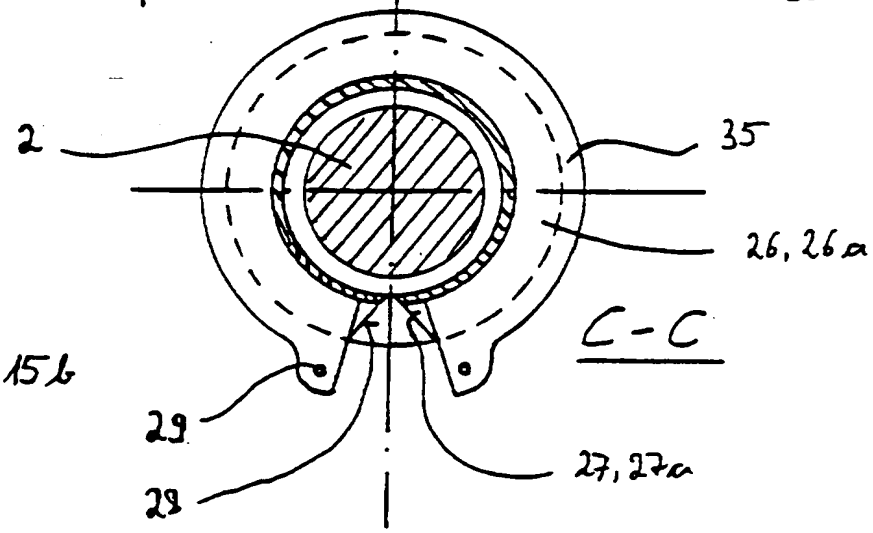


Fig. 15b

INTERNATIONAL SEARCH REPORT

In tional Application No
PCT/EP 97/00275

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E21C35/19 E21C35/197

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 012 838 A (MARWING MINING TOOLS) 1 August 1979 see the whole document	1,4-6,8, 9,14-16, 18,24,27
A	EP 0 163 590 A (HUGHES TOOL CO) 4 December 1985 see figures	1,28-32, 35,37
A	US 4 952 001 A (FANSTEEL INC.) 28 August 1990 see figures	1,20,21, 28,30, 32-34
A	GB 1 086 264 A (AUSTIN HOY) 4 October 1967 see figures	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
7 May 1997	20.05.97
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Authorized officer Fonseca Fernandez, H

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INTERNATIONAL SEARCH REPORT

Ir. tuonal Application No
PCT/EP 97/00275

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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